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take an arc equal to any angle ϕ from axis of x. Draw a line from the upper limit of the arc to the origin. From the point P, where this line cuts the curve $r=\dfrac{a\sin\theta}{\sin3\theta}$, draw a line parallel to axis of x cutting the given arc. From this point draw a line to O making an angle$=\frac{1}{3}\phi$.

c) The equation of the locus of P would be $r=\dfrac{a\sin\theta}{\sin n\theta}$, and the multisection would be similar to the trisection.

NOTE. By projecting parallel to the y-axis Dr. Zerr obtains in a similar way the locus $r=\dfrac{a\cos\theta}{\cos n\theta}$, and effects the n-section of the angle in a manner similar to the above. ED.

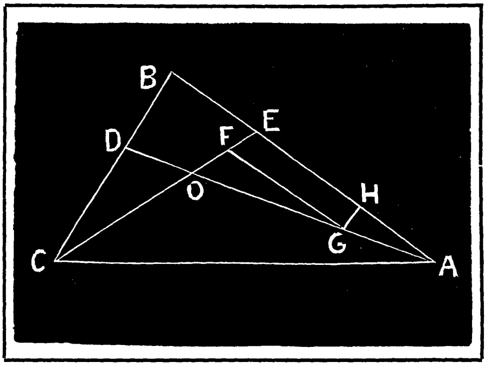
285. Proposed by G. E. BROCKWAY, Nashua, N. H.

Prove without the aid of the circle, that if the bisectors of the angles of a triangle be drawn, the greatest bisector falls on the least side.

I. Solution by ALFRED H. PARROTT, North Dakota Agricultural College, N. D.

Given scalene triangle ABC, and bisectors of angles A and C, supposing $\angle C>\angle A$. If $\angle C>\angle A$, then side $AB>$side BC, and we are to prove bisector AD on side $BC>$bisector CE on side AB. If $\angle C>\angle A$, $\angle OCA>\angle OAC$ [If wholes are unequal, then halves, etc.].

$\therefore AO>OC$ [If angles of a triangle, etc.]. Now if $OD>$ or $=OE$, the proposition is evident. But suppose $OD<OE$. Then on OE take $OF=OD$, and on OA take $OG=OC$, and draw FG. Then draw GH parallel to CE.



$\triangle\,FOG=\triangle\,COD$ [Three sides on one equal respectively, etc.]. Then $\angle FGO=\angle DCO>\angle EAO$ [Halves of unequals, etc.].

Consider $\triangle FGO$ and $\triangle EAO$; $\angle O\equiv\angle O$, $\angle FGO>\angle EAO$ [Previous proof]. Therefore $\angle GFO<\angle AEO$.

A line drawn parallel to FG and through E will then intercept HG between H and G and HG is therefore $>EF$.

Now $\angle AHG>\angle HAG$, for $\angle AHG=\angle AEC$, [sides respectively parallel], $\angle AEC=\angle B+\angle ECB$ [Exterior angle of a triangle equals sum of, etc.]. But $\angle HAG<\angle ECB$, and therefore $<\angle B+\angle ECB$, and hence $<\angle AHG$.

$\therefore AG>HG>EF$, or $AO-GO>OE-OF$,

$AO+OF>OE+GO$, $AO+OD>EO+OC$.

Hence $AD>EC$. Q. E. D.

II. Solution by J. SCHEFFER, A. M., Hagerstown, Md.

Let in a triangle ABC $AB>AC$, and BE and CD be the bisectors of angles B and C of the triangle, cutting AC and AB in E and D, respectively. To prove $CD<BE$.

Through E draw EH parallel to CB. Draw HI parallel to AC, and HK parallel to DC, cutting AC in K. It is evident that $HE=HB$, and $HE=EK$; moreover, $\angle HIB=\angle ACB>\angle HBI$. Therefore, $BH>HI$, and hence $EK>HI$ or EC. The point K, therefore, lies on AC produced, and hence, the point D between A and H. Comparing the two triangles BHE and HEK, we see at once that $BE>HK$. But $CD<HK$, *a fortiori*. Therefore $CD<BE$.

Also solved by Henry Heaton, A. H. Holmes, Rev. J. H. Meyer, and G. B. M. Zerr.

286. Proposed by S. F. NORRIS, Baltimore City College, Baltimore. Md.

On the sides of a given triangle measure off equal distances from the extremities of the base, and at these points erect perpendiculars to the sides. Find the locus of the point of intersection of these perpendiculars. Solve by methods of analytic geometry.

Solution by G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va.

Let ACB be the triangle, AB the base. Lay off $AE=BD=d$ on the two sides AC, BC, and erect perpendiculars at E and D cutting each other at H, and CB and AC at F and G, respectively. Then $CE=b-d$, $CF=(b-d)\sec C$.

Hence $\dfrac{x}{(b-d)\sec C}+\dfrac{y}{b-d}=1$, is the equation to EF..........(1).

Also $CD=a-d$, $CG=(a-d)\sec C$, and $\dfrac{x}{a-d}+\dfrac{y}{(a-d)\sec C}=1$, is the equation to DG..........(2). Now (1) and (2) may be written as follows:

$$x\cos C+y=b-d \;........\; (3),$$
$$x+y\cos C=a-d \;.........\; (4).$$

Eliminating d we get $x-y=\dfrac{a-b}{1-\cos C}=\frac{1}{2}(a-b)(\operatorname{cosec}\frac{1}{2}C)^2$, as the locus of H, the intersection required.

Also solved by G. W. Greenwood, Henry Heaton, A. H. Holmes, and J. Scheffer.

287. Proposed by G. W. GREENWOOD, M. A., McKendree College, Lebanon. Ill

Show that the points whose abscissae are 0, $a\sqrt{3}$, and $-a\sqrt{3}$ are points of inflexion on the locus $x^2y-a^2x+a^2y=0$.

Solution by the PROPOSER.

Let P be the point whose abscissa is $a\sqrt{3}$ and whose ordinate is therefore $\dfrac{a\sqrt{3}}{4}$. Let Q be any point on the curve. The coördinates of Q are, therefore,